Stoller
Hanford Office

GJO-2004-571-TAC

C4219
Log Data Report
(REVISED)

Borehole Information:

Borehole: C4219			**Site:** 216-U-8 Crib		
Coordinates (WA State Plane)		**GWL (ft)[1]:** Dry		**GWL Date:**	01/27/2004
North	**East**	**Drill Date**	**TOC[2] Elevation**	**Total Depth (ft)**	**Type**
Not Available	Not Available	Jan. 2004	Not Available	50	Push Hole

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Threaded steel	1.0	6 5/8	5 5/8	1/2	1.0	48.5

Borehole Notes:

The logging engineer measured a sample of casing located in a lay-down area next to the borehole. Casing diameter was measured using a caliper and a steel tape, and measurements were rounded to the nearest 1/16 in.

Logging Equipment Information:

Logging System:	Gamma 1E		**Type:** SGLS (70%) 34TP40587A
Calibration Date:	01/2004	**Calibration Reference:**	GJO-2004-568-TAC
		Logging Procedure:	MAC-HGLP 1.6.5, Rev. 0

Logging System:	Gamma 1C		**Type:** High Rate Detector
Calibration Date:	04/2003	**Calibration Reference:**	GJO-2003-429-TAC
		Logging Procedure:	MAC-HGLP 1.6.5, Rev. 0

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	**1**	**2 / Repeat**	**3**		
Date	01/27/04	01/27/04			
Logging Engineer	Spatz	Spatz			
Start Depth (ft)	48.5	31.5			
Finish Depth (ft)	0.5	25.5			
Count Time (sec)	100	100			
Live/Real	R	R			
Shield (Y/N)	N	N			
MSA Interval (ft)	1.0	1.0			

Log Run	1	2 / Repeat	3		
ft/min	N/A[3]	N/A			
Pre-Verification	AE071CAB	AE071CAB			
Start File	AE073000	AE073049			
Finish File	AE073048	AE073055			
Post-Verification	AE074CAA	AE074CAA			
Depth Return Error (in)	0	0			
Comments	No fine-gain adjustment.	No fine-gain adjustment.			

High Rate Logging System (HRLS) Log Run Information:

Log Run	1	2 / Repeat			
Date	03/24/04	03/24/04			
Logging Engineer	Spatz	Spatz			
Start Depth (ft)	46.0	36.0			
Finish Depth (ft)	32.0	34.0			
Count Time (sec)	300	300			
Live/Real	R	R			
Shield (Y/N)	N	N			
MSA Interval (ft)	1.0	1.0			
ft/min	N/A	N/A			
Pre-Verification	AC092CAB	AC092CAB			
Start File	AC093000	AC093015			
Finish File	AC093014	AC093017			
Post-Verification	AC094CAA	AC094CAA			
Depth Return Error (in.)	N/A	0			
Comments	No fine-gain adjustment.	Repeat section.			

Logging Operation Notes:

Logging was performed with a centralizer installed on the sonde. Pre- and post-survey verification measurements for the SGLS employed the Amersham KUT (^{40}K, ^{238}U, and ^{232}Th) verifier with serial number 118. Logging started at the nearest 0.5-ft interval after reaching total depth. The maximum logging depth is 48.5 ft. Zero reference is the ground surface.

Analysis Notes:

Analyst:	PDH & SMS	**Date:**	03/29/04	**Reference:**	GJO-HGLP 1.6.3, Rev. 0

This Log Data Report has been revised to include high rate data and replaces the report issued 2/11/04. SGLS pre-run and post-run verification spectra were collected at the beginning and end of the day. All of the verification spectra were within the acceptance criteria. Examinations of spectra indicate that the detector functioned normally during logging, and the spectra are accepted.

HRLS pre-run and post-run verification spectra were collected at the beginning and end of the day. The spectra were within the acceptance criteria for the field verification of the Gamma 1C logging system (HRLS).

Log spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Verification spectra were used to determine the energy and resolution calibration for processing the data using APTEC SUPERVISOR. Concentrations were calculated in EXCEL (source files: G1GJan04.xls [SGLS] and G1CApr03.xls [HRLS]). Zero reference was the ground surface. Based on the field measurements, the casing configuration was assumed as one string of 6-in. casing with a thickness of 1/2 in. to 48.5 ft (total logging depth). A water correction was not required.

Using the SGLS, dead time greater than 40 percent was encountered in the interval from 32.5 to 44.5 ft. Data from this region are considered unreliable. At SGLS dead time greater than 40 percent, peak spreading and pulse pile-up effects may result in underestimation of activities. This effect is not entirely corrected by the dead time correction, and the extent of error increases with increasing dead time. The HRLS was utilized to obtain data where the SGLS dead time exceeded 40 percent. SGLS and HRLS dead time corrections were applied when dead time surpassed 10.5 percent.

Log Plot Notes:

Separate log plots are provided for gross gamma and dead time, naturally occurring radionuclides (^{40}K, ^{238}U, and ^{232}Th), and man-made radionuclides. Plots of the repeat logs versus the original logs are included. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, or casing correction. These errors are discussed in the calibration report. A combination plot is also included to facilitate correlation. The ^{214}Bi peak at 1764 keV was used to determine the naturally occurring ^{238}U concentrations on the combination plot rather than the ^{214}Bi peak at 609 keV because it exhibited slightly higher net counts per second.

Results and Interpretations:

^{137}Cs and processed uranium (^{238}U and ^{235}U) were the man-made radionuclides detected in this borehole. ^{137}Cs was detected in the interval between 30.5 and 48.5 ft with concentrations ranging from 0.3 to 51,400 pCi/g. The maximum concentration was measured at 35 ft.

^{238}U, as inferred from the ^{234m}Pa 1001-keV energy peak, was detected between 40 and 45 ft. The maximum concentration was 3,100 pCi/g at 43.5 ft. ^{235}U, which is measured directly by the 186-keV energy peak, is usually detected where the ^{234m}Pa energy peak is detected at a ratio of approximately 1:20. ^{235}U was detected between 41 and 46 ft with a maximum concentration of 141 pCi/g at 43.5 ft. The MDLs for ^{238}U and ^{235}U in the high ^{137}Cs interval between 32.5 and 43.5 ft may exceed approximately 3,000 and 150 pCi/g, respectively. Thus, processed uranium may exist in the high activity zone even though it was not detectable.

The plots of the repeat logs demonstrate reasonable repeatability of the HRLS and SGLS data. ^{137}Cs (662 keV) concentrations are comparable between the repeat and original HRLS log runs. The natural radionuclides at energy levels of 609, 1461, 1764, and 2614 keV are comparable between the repeat and original SGLS log runs.

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[1] GWL – groundwater level
[2] TOC – top of casing
[3] N/A – not applicable

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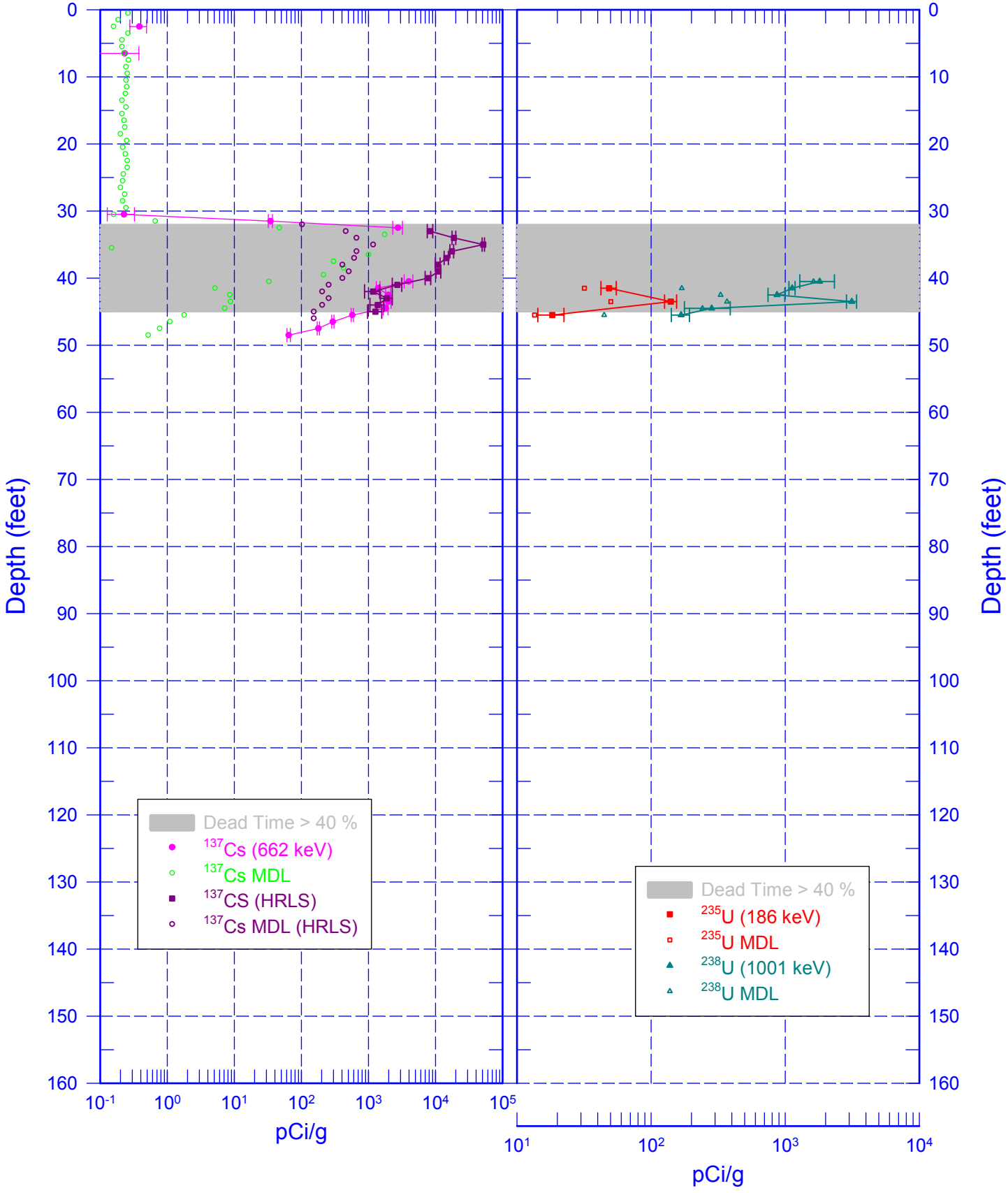
Man-Made Radionuclides



Zero Reference = Ground Surface

Depth Scale: 1"=20 ft

Last Log Date - 03/24/04

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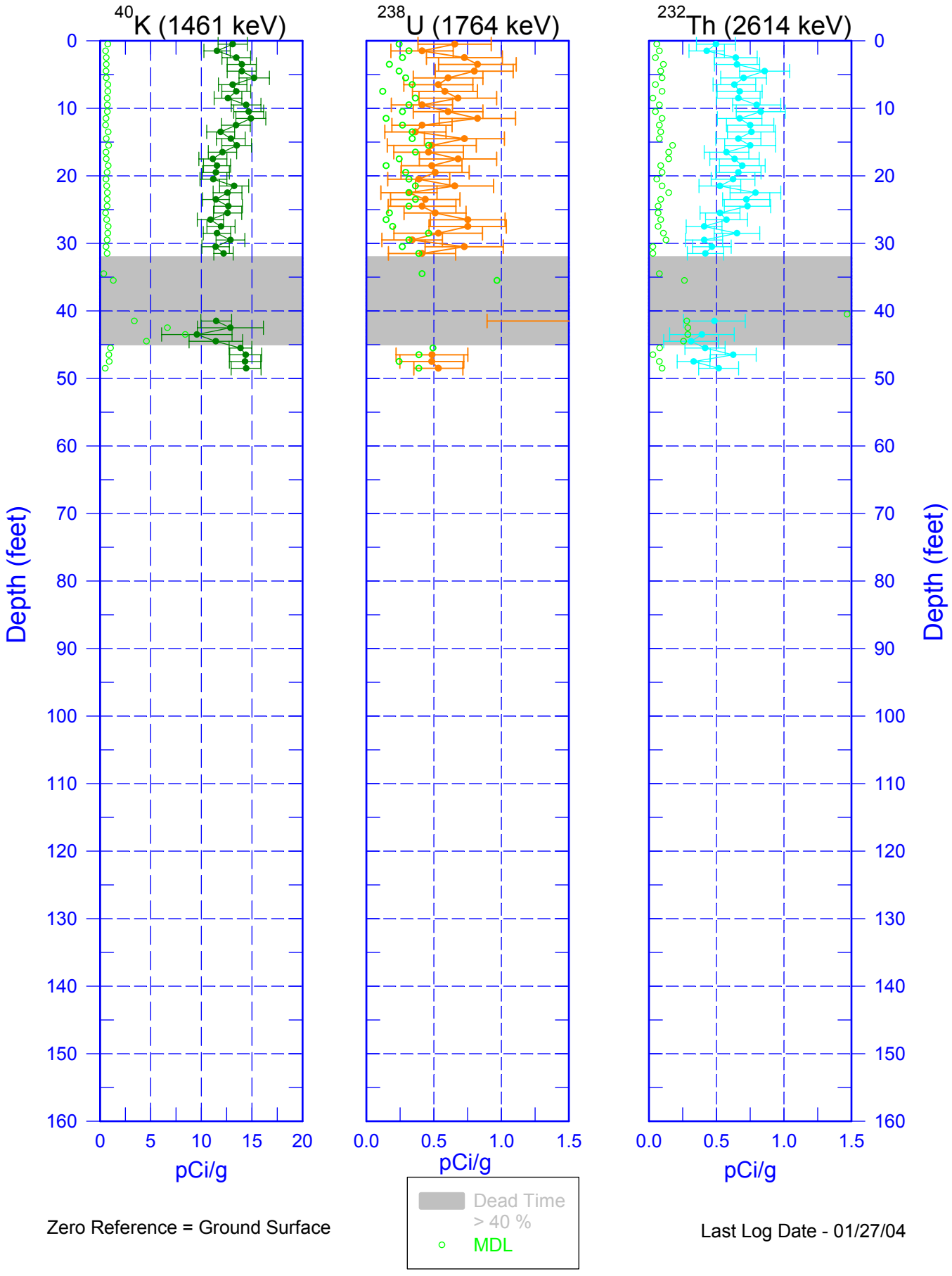
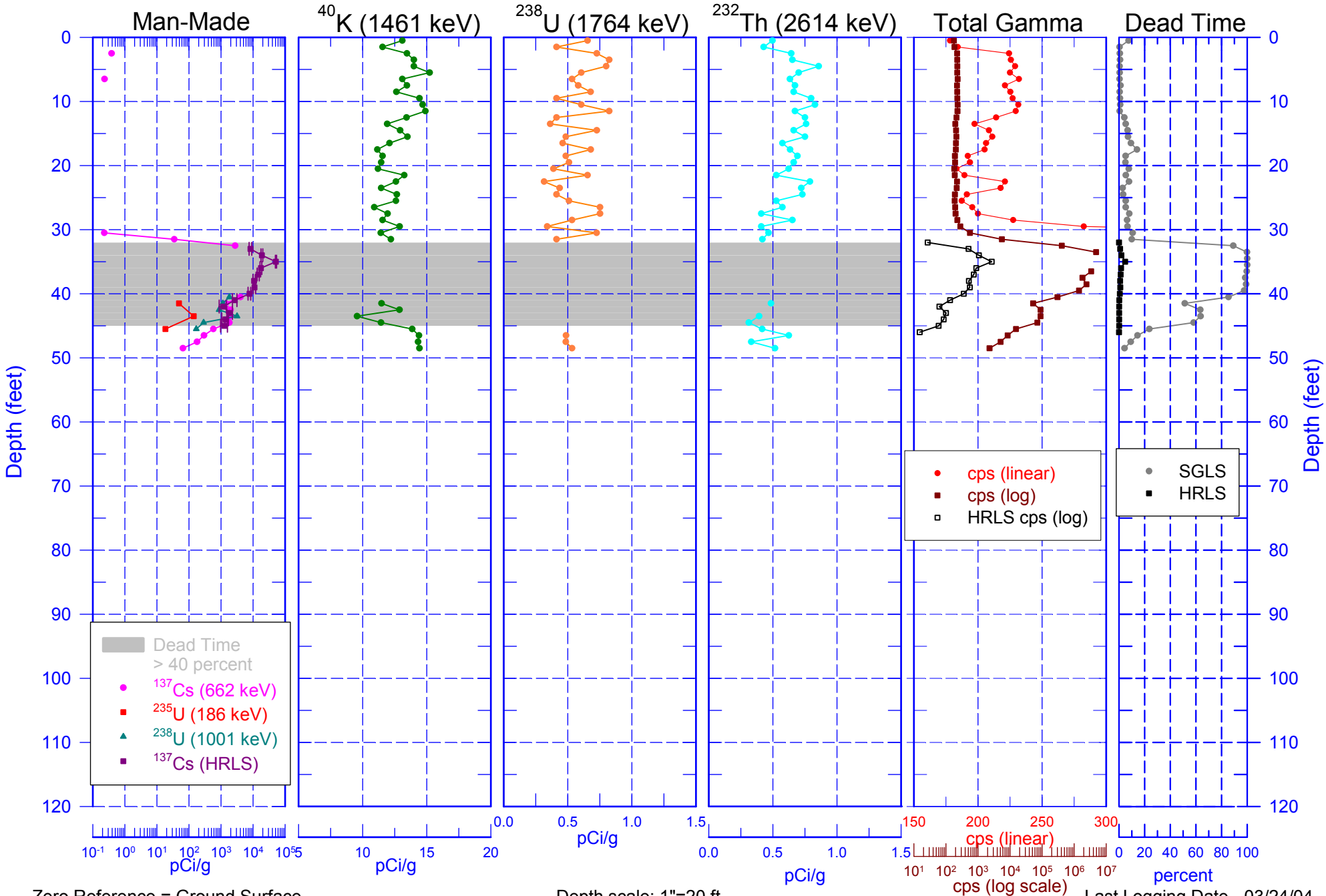
Natural Gamma Logs



Zero Reference = Ground Surface

Last Log Date - 01/27/04

C4219 Combination Plot

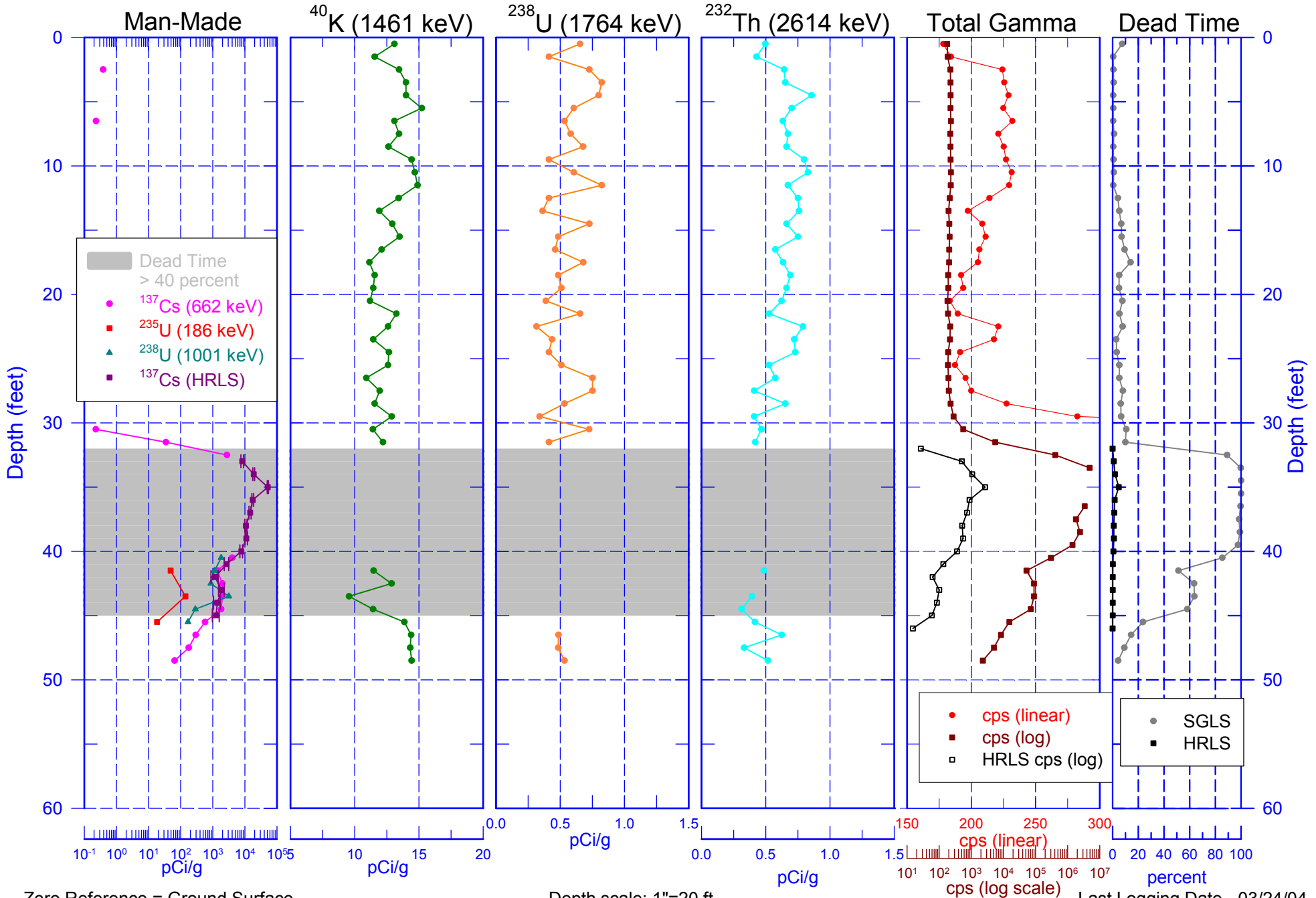


Zero Reference = Ground Surface

Depth scale: 1"=20 ft

Last Logging Date - 03/24/04

C4219 Combination Plot



Zero Reference = Ground Surface

Depth scale: 1"=20 ft

Last Logging Date - 03/24/04

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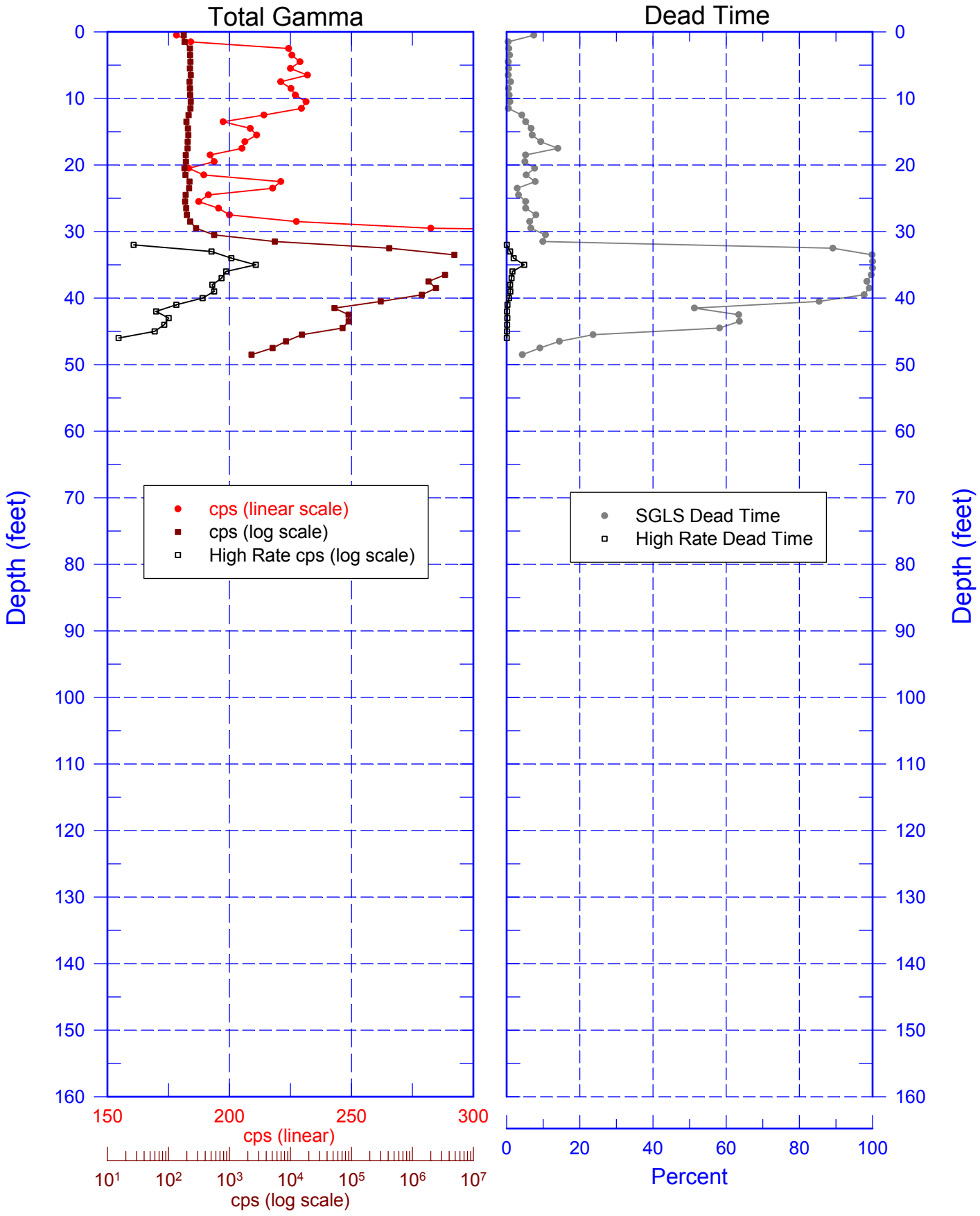
Total Gamma & Dead Time



Depth scale:1"=20 ft

Reference - Ground Surface

Last Log Date - 03/24/04

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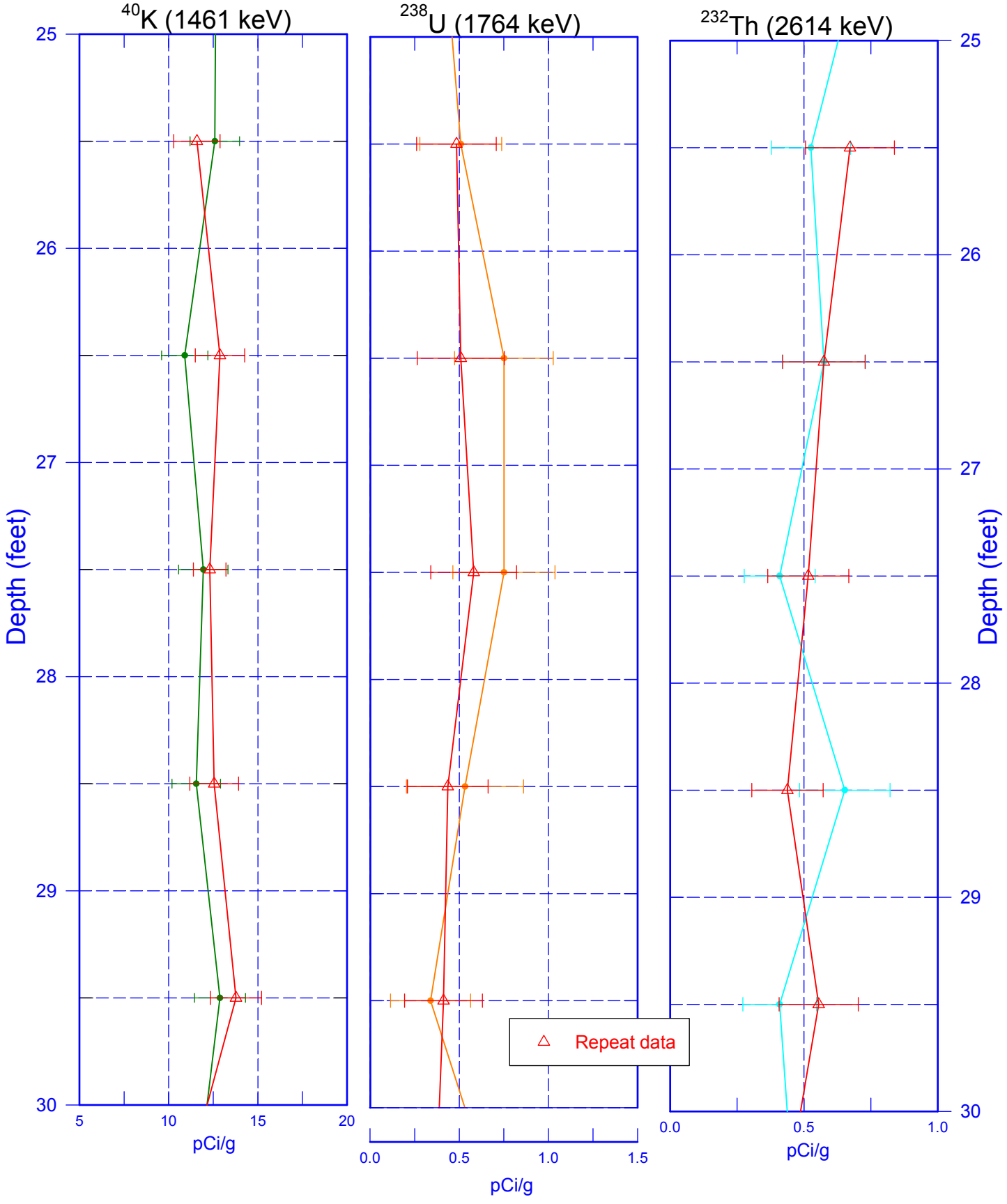
Repeat Section of Natural Gamma Logs



Zero Reference = Ground Surface

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Rerun of Man-Made Radionuclides